DISTRIBUTION OF NATURAL AND ARTIFICIAL RADIONUCLIDES IN PREALPINE LAKE SEDIMENTS

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Vertical distributions of natural radionuclides ^{234}Th, ^{226}Ra, ^{214}Bi, ^{214}Pb, ^{210}Pb (^{238}U decay series), ^{228}Ac, ^{212}Bi, ^{212}Pb (^{232}Th decay series), ^{235}U, and ^{40}K have been studied in several sediment cores (70 - 130 cm length) taken in 2009 from two prealpine lakes – Lake Lucerne and Lake Brienz (Switzerland). Freeze-dried sediment samples (layer thickness of 1 cm) were measured γ-spectrometrically using Broad Energy Germanium detectors (Canberra-Eurisys). The spectra were analyzed using single photon peak efficiencies generated by LabSOCS calibration software which takes into account self-absorption of γ-rays both in samples and beakers. For cascading nuclides (e.g. ^{134}Cs, ^{214}Bi, ^{214}Pb), a cascade summing correction was executed using Genie2000 V3.2 spectroscopy software.

Artificial radionuclides ^{137}Cs and ^{241}Am have been used for establishing the age-depth relation in the sediments. These radionuclides are present in the sediments due to the global fallout after the nuclear weapons testing in the 1950 - 60s. An additional peak in the upper part of the ^{137}Cs profile corresponds to the fallout after the Chernobyl accident in 1986.

An alternative approach in age determination of the sediments by the unsupported ^{210}Pb based on Constant Input Concentration (CIC) and Constant Rate Supply (CRS) models (Appleby and Oldfield, 1978) was used. With the CRS model also time-dependent sedimentation rates were determined. They are larger after about 1960 than before which is indicated also by a change in the slope of the depth-age relation.. Short period increases in the sedimentation rate might be caused by turbidity flows in the lake, blooming of algae or other processes.

An average loss of about 10 % of supported ^{210}Pb from the sediment samples due to diffusion of ^{222}Rn out of the sample has been estimated by analyzing total and supported ^{210}Pb at larger depths. Consequently, the measured activity concentration of unsupported ^{210}Pb had to be corrected for this loss to establish the correct depth-age relation in the sediment core.

The results from the different models agree very well within the uncertainties back to 40 - 65 years for different sediment cores. However, it was not possible to determine the age of the layers older than 100 years, due to counting statistics and due to large uncertainties in the extrapolation of the integration of the unsupported ^{210}Pb inventory down to infinity (CRS model).

A distinctive feature of studied sediment cores was a decrease of the unsupported ^{210}Pb towards the top layer which was observed in most of the vertical profiles. The maximal activity concentration was found between 4 and 7 cm and not in the top layers as expected. This effect can not be explained by an increasing bulk density with depth. The same

effect was observed in previous investigations of sediments from the prealpine lake Lago Maggiore (Italy, Switzerland).
More general results of the vertical distribution of radionuclides in sediments and a comparison of dating methods will be presented at the conference.